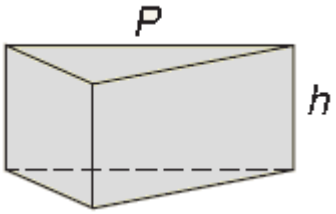
Prism and Cylinder

Part A: Prism

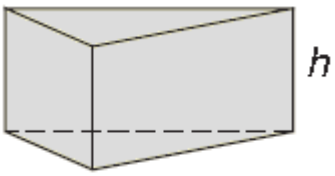
Theorem 1: If a prism has a lateral area of L square units and a height of h units and each base has a perimeter of P units, then $L = Ph$.

$$L = Ph$$



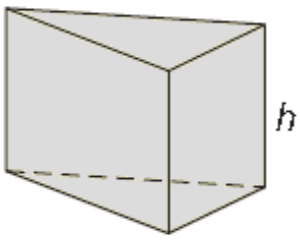
Theorem 2: If a prism has a surface area of S square units and a height of h units and each base has a perimeter of P units and an area of B square units, then $S = Ph + 2B$.

$$S = Ph + 2B$$



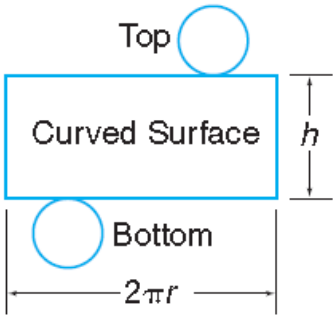
Theorem 3: **Volume of a Prism:** If a prism has a volume of V cubic units, a base with an area of B square units, and a height of h units, then $V = Bh$.

$$V = Bh$$



Part B: Cylinder

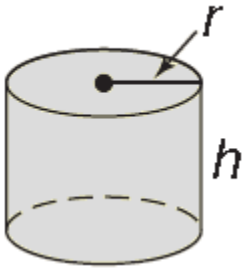
The lateral area of a cylinder is the area of the curved surface. If a cylinder were cut across the lateral side and unfolded, it would resemble a rectangle. Its **net** is shown below. A net is a two-dimensional pattern that folds to form a solid.



The width of the rectangle is the height *h* of the cylinder. The length of the rectangle is the distance around the circular base, or the circumference, $2\pi r$.
Since l=$2\pi r$ and *w*=*h*, *L*=*lw* becomes *L* = $(2\pi r)h$.

Theorem 4: If a cylinder has a lateral area of *L* square units and a height of *h* units and the bases have radii of *r* units, then $L = 2\pi rh$.

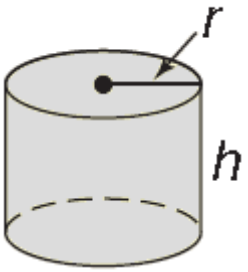
$$L = 2\pi rh$$



The surface area of a cylinder is still found by using S = L + 2B.
However, L can be replaced with 2π rh, and B can be replaced with πr^2.

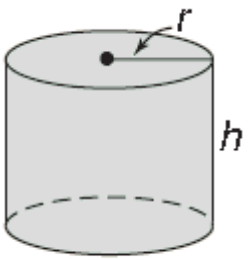
Theorem 5: If a cylinder has a surface area of *S* square units and a height of *h* units and the bases have radii of *r* units, then $S = 2\pi rh + 2\pi r^2$.

$$S = 2\pi rh + 2\pi r^2$$



Theorem 6: Volume of a Cylinder: If a cylinder has a volume of V cubic units, a radius of r units, and a height of h units, then $V = \pi r^2 h$.

$$V = \pi r^2 h$$



Example 1: A prism measures 15 cm by 12 cm by 8 cm. Find the capacity of the prism.

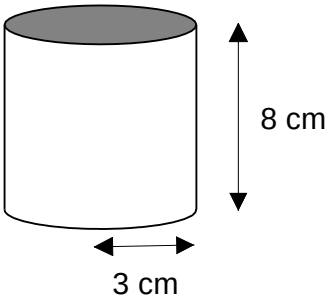
Volume = 15 × 12 × 8 = 1440 cm^3.

Example 2: A cylinder has a volume of 965 cm^3. If the height of the cylinder is 16 cm, find the radius.

Substitute the information from the question into the formula for the volume of a cylinder:
Volume of cylinder = $\pi r^2 h$
$\Rightarrow 965 = \pi \times r^2 \times 16$
$\Rightarrow 965 = \pi \times 16 \times r^2$
$\Rightarrow 965 = 50.26548 \times r^2$
$\Rightarrow 19.198 = r^2$
$\Rightarrow 4.38156 = r$
So the radius of the cylinder is 4.4 cm

Example 3: A cylinder is made from metal. It has a base but no lid. The height of the cylinder is 8 cm. The radius of the cylinder is 3 cm.

Find the amount of metal required to make the cylinder.
Leave your answer in terms of π.



The area of the base is $\pi r^2 = \pi \times 3^2 = 9\pi$
The curved surface area is $2\pi rh = 2 \times \pi \times 3 \times 8 = 48\pi$
So the area of metal required = $9\pi + 48\pi = 57\pi \text{ cm}^2$